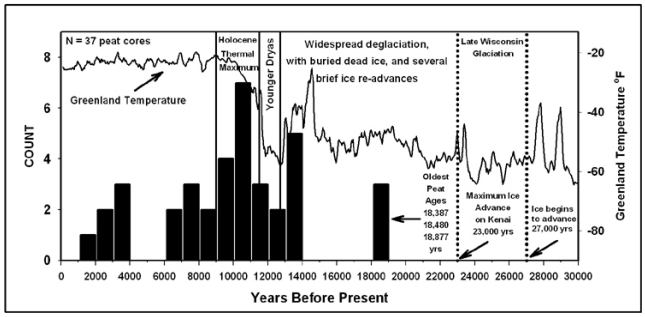
Peat deposits record postglacial climate history of the Kenai

by Ed Berg



Greenland data from Richard Alley, Penn State University.

Old timers who came to the Kenai after World War II have seen glaciers like Portage, Tustumena and Grewingk steadily pulling back into the mountains. These glaciers are small relicts of the ice sheets that extended out across the Kenai lowland and filled Kachemak Bay, and locally merged with even larger glaciers that came across Cook Inlet from the Alaska Range. The action climaxed 23,000 years ago at the height of the last glaciation.

The steady retreat of present-day glaciers provides a somewhat misleading picture of how the big glaciers departed. The truth is, the last glacial period ended with a bang, or several bangs, not a whimper, relatively speaking. It took about 3-4,000 years for the glaciers to spread from the Harding Icefield and the Alaska Range to cover up the Kenai lowland and the broad river valley to the west that was the ancestral Cook Inlet.

After 23,000 years ago the Earth's climate began to warm rapidly, not uniformly but with major warmings and coolings, until the last warming leveled off about 10,000 years ago. (This thermal history is recorded in the 10,000-foot ice-core punched through the Greenland icecap, which provides a detailed record of the Northern Hemisphere climate for the last 110,000 years.) Between 23,000 and 11,500 years ago, the Kenai glaciers literally fell apart; they didn't have time for genteel retreat. The result was a landscape covered with huge blocks of foundered ice. As these blocks melted they left depressions called "kettle holes" which contain most of our lakes on the Kenai.

During the maximum glaciation, large lakes formed between the east and west lobes of the glaciers. The glacial lakebed remnants can be seen today running from the extensive muskeg northeast of Sterling, down through Coal Creek east of the Sterling Highway and intermittently east along the Sterling Highway all the way to Anchor Point.

These glacial lakebeds and many kettle holes have filled with peat since the end of the last glacial period. As part of our studies of long-term climate history on the Kenai we have been taking peat core samples from many sites around the Peninsula and obtaining radiocarbon dates on the peat age. This is part of the graduate thesis studies of our two graduate students Kacy McDonnell and Allana DeRuwe at Alaska Pacific University.

When we take a peat core, we drive a three inch stainless steel tube down through the peat, rotating the tube back and forth so that its serrated teeth cut through the peat. We stop when we hit mineral soil. This process gets harder as you go deeper, and sometimes the peat is very thick. We have cored peat as thick as 20 feet and still not hit bottom, but usually the peat is more like eight to 12 feet thick.

The graph shows the basal (bottom) ages of the peat for 37 cores, collected by ourselves and other investigators. The basal age, determined by radiocarbon dating, represents the time when peat began to accumulate at the site. In some sites shallow lakes dried sufficiently for vegetation to begin filling in a pond or lake basin. At other sites dry surfaces (e.g., drained glacial lakebeds) were colonized by Sphagnum moss, which can store water and create a wetland where there was none previously. (In past wars Sphagnum moss was used as a wound dressing because one dry ounce of Sphagnum can hold a pint of blood.)

On the graph the three oldest peat deposits are more than 18,000 years ago. Two of these (No Name Creek and Funny River Horse Trail) are in glacial sluiceways that drained runoff waters from melting

icesheets. The third is from the flank of the Caribou Hills (Tall Tree Rd), which were not glaciated during the last glacial period.

Serious peat formation on the Kenai got underway after 14,000 years ago, as the graph shows. Most of the landscape was pretty well exposed by this time. There was a dramatic cold snap starting 12,700 years ago, that lasted for 1300 years. This cold period (called the Younger Dryas) was due to a full shut down of the Atlantic Ocean heat conveyor belt (including the Gulf Stream) that brings heat to Europe and northeastern North America. We have seen this cold snap expressed in pond sediments in the Swanson River oilfield, and it appears to have slowed new peatland recruitment on the Kenai (11,000 to 13,000 years ago on the graph).

Eleven of the 37 sites began to accumulate peat during the warm Holocene Thermal maximum, which in Alaska roughly spans the period 11,500 to 9,000 years ago. Peat only forms in cool climates, but this period, even though warmer, likely had heavier winter snowfall which provided more growing season water for poorly drained flat surfaces and kettles and thus initiated peat accumulation.

The next pulse of peat recruitment starts about 4000 years ago. We know from the sediment record at Paradox Lake that black spruce pollen became more abundant and forest fire charcoal decreased at this time, both of which indicate a cooler and wetter climate.

I am puzzled by what was growing at these later sites during the thousands of years between the time that the glacial ice left and peat began to accumulate. For peat to accumulate, the vegetation growth rate logically has to exceed the rate of decomposition. At relatively dry sites perhaps the vegetation simply couldn't grow faster than it rotted, until the climate got cooler or wetter. It is also possible that fire could have removed vegetation, once or many times. At wet sites (former lakes or ponds) the climate must have gotten warmer or drier to lower the water level enough for vegetation to accumulate as peat. In any case there is a time gap at the bottom of most of these peat cores, which poses yet another mystery for future investigations.

I would like to thank geologist Dick Reger for providing dates for the glacial events, as well as some of the peat radiocarbon dates.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. He is an adjunct instructor at the Kenai Peninsula College and lives with his wife Sara in Homer. Previous Refuge Previous Refuge Notebook columns can be viewed on the Web at http://www.fws.gov/refuge/kenai/.